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SOILS OF THE EASTERN UNITED STATES AND THEIR USE—XXXIV.

THE MARION SILT LOAM.

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THE MARION SILT LOAM.

GEOGRAPHICAL DISTRIBUTION.

The Marion silt loam is an extensively developed prairie soil occurring in southern Illinois and in east-central Missouri. Four soil surveys, located in these two States, have included 694,040 acres of this type within their limits. A considerable area of the type is to be found to the south of the region in which it has thus far been mapped in southern Illinois, and it is probable that the total area of this soil amounts to several million acres.

CHARACTER OF SOIL AND SUBSOIL.

The surface soil of the Marion silt loam to an average depth of 12 inches is a gray, ash-colored, or yellowish-white silty loam which normally consists of 70 to 80 per cent of silt with which is mingled an appreciable quantity of fine and very fine sand and about 10 per cent of clay. This is underlain by a layer of white, powdery, siliceous silt, containing numerous small concretions of hydrated iron oxide. In some instances this layer is fully a foot thick; in others it is almost wanting. The deeper subsoil consists of a hard, intractable, silty clay having a mottled gray and brownish-yellow color. When dry this clay becomes checked and jointed, but when wet it is sticky and dense. At varying depths this material rests upon a gravelly boulder clay which underlies the entire region. The total depth of the soil and subsoil, over the underlying till, varies from 2 or 3 feet to 10 or 15 feet.

The Marion silt loam is easily distinguished from the other soils of the region in which it occurs by the gray or ash-colored surface soil and the almost universal presence of the "hardpan" layer. The other silty soils of the region are prevalently dark brown or yellowish brown at the surface, and their subsoils are far less compact and impervious.

SURFACE FEATURES AND DRAINAGE.

Throughout the region in which the Marion silt loam predominates in south-central Illinois the surface of the country consists of a broad, nearly level upland interrupted only by low, rolling morainal ridges and by the broad shallow valleys of the main

streams and the narrower trenches of their local tributaries. The surface of this plain is chiefly occupied by the Marion silt loam, and in some regions it comprises nearly 90 per cent of entire counties. It is the dominant soil of the gray prairies, and is only interrupted by the darker colored silty soils covering the morainal ridges and distributed along the bluffs of larger streams like the Mississippi River. In east-central Missouri the surface of the Marion silt loam is considerably more rolling, and it is even found upon some of the steeper slopes adjacent to the larger streams.

In general the Marion silt loam is marked by an almost flat surface which only locally is interrupted by slopes or more rolling topography.

The absolute elevation of the Marion silt loam above sea level ranges from an altitude of approximately 500 feet in south-central Illinois to elevations of about 750 feet in Missouri. It is usually found at an elevation of 10 to 50 feet above the channels of the streams which flow through the prairie.

The natural drainage of the Marion silt loam is poor. In fact, the first settlers upon these prairies found them to be wet and swampy, with many ponds and bogs scattered over the surface. The drainage conditions have been improved considerably since that time, but even now, after the heavy rains of winter and spring, water stands for considerable periods over the more level surfaces remote from natural drainage channels. The almost level surface, the dense and slightly pervious subsoil, and the general presence of a "hardpan" layer at the surface of the subsoil, all tend to prevent adequate surface or internal drainage of the type. Improvement in this respect constitutes one of the greatest needs of the Marion silt loam.

In some restricted areas, where the Marion silt loam adjoins the deeper-cut stream channels, some difficulty is experienced with soil erosion. The surface soil is removed by the rains of winter and spring, exposing the white silty "hardpan" layer at the surface and practically destroying the agricultural value of the soil. Such areas are confined to the steeper slopes and constitute only a small percentage of the total extent of the type.

LIMITATIONS IN USE.

The physical characteristics of the Marion silt loam decidedly restrict its uses for agricultural purposes. The compact condition of the subsoil, the presence of the "hardpan" layer, and the general deficiency in natural drainage all tend to limit variety in agriculture and nearly all of the deeper-rooting crops are produced only at a disadvantage. This excludes corn from profitable cultivation and restricts the Marion silt loam to the growing of winter wheat, oats,

and hay. Even with the latter crop timothy and redtop are better suited to the soil than the clovers, although the latter may be grown.

Winter grain is best suited for production upon the Marion silt loam. It may be seeded before the autumn rains set in, making its chief growth upon the winter moisture supply, to be harvested before the droughts of midsummer. This fact, together with the shallow rooting of the small grains, permits of the seeding of a very large percentage of the type to winter wheat which gives fair to good yields. Corn is not generally grown with success upon the type, as it is a deeper-rooting crop, dependent upon the spring and summer rains to a far greater extent than winter wheat and is more liable to suffer severely from the droughts of July and August than any other crop commonly planted upon this soil. As a result the acreage planted to corn upon the Marion silt loam is restricted and shows a decline in certain localities.

The organic matter content of the surface soil of the Marion silt loam is almost universally deficient. The ashy-gray color of the soil is a sufficient indication of this fact and analyses have shown the organic matter content to range from less than one-half of 1 per cent to a maximum slightly above 2 per cent. As a result the mechanical condition of the surface soil is poor and there is a constant tendency toward compacting under tillage. This condition is unfavorable to corn cultivation though less so to the growing of winter wheat.

In addition to the normal difficulties resulting from lack of proper drainage, there is a tendency toward drowning out the winter grain crop upon all of the more level areas where water may stand for many days over the grain. This tendency has been met by the plowing of the lands into long narrow ridges, with water furrows between, for the surface drainage of the fields. In many localities the drainage has also been improved by the establishment of open ditches, which serve fairly well to relieve this condition of unfavorable surface drainage.

Climatically, the type is located within a region well suited to the production of a wide range of general farm crops. The chief restrictions upon the use of this soil are, therefore, consequent upon its dense subsoil and upon the extremely level surface topography, both of which interfere with the adequate surface and internal drainage of the type.

IMPROVEMENTS IN SOIL EFFICIENCY.

The first and most general need for improving the range of crop adaptations of the Marion silt loam as well as its productivity is adequate drainage. This can not be accomplished on the basis of individual effort, especially so far as the construction of the larger

main outlets is concerned, but should be undertaken as a community problem. The drainage of individual farms could then be led into the mains and complete drainage secured.

It is probable that, for the main lines, open ditches should be dug. Into these the larger lines of tile could empty, gathering, in turn, the drainage from individual farms.

In Illinois adequate State laws exist for the formation of drainage districts.

The chief problem in draining this type of soil will arise from the dense, impervious nature of the subsoil, which will retard the percolation of water into the tile. It is probable that the tile should be laid at depths ranging from 3 to 4 feet below the surface, and even then the frequency of tile lines will need to be carefully adjusted to accomplish complete drainage. Although the prairie is apparently nearly level, there are few areas which do not possess sufficient gradient to allow of the proper fall in the open ditch and tile lines.

In the absence of any definite data, it would be almost impossible to estimate the acreage cost for the installation of complete drainage for the Marion silt loam. Areas of the dark prairies of the northern part of Illinois have been drained at an average cost ranging from \$12 or \$15 for the more simple cases to \$25 per acre or more where greater difficulties have been encountered. In these instances the original cost of drainage has been repaid many times over by the increased yields of crops and by the far greater certainty of producing a paying crop each year. In the case of the Marion silt loam an additional advantage would be secured in that drainage is almost absolutely essential to the production of corn. The extensive apple orchards upon the type would also benefit to a very great degree by the improvement of drainage conditions.

Next to improved drainage, which is a community problem, the increase of the organic matter content of the surface soil is one of the most essential improvements to be accomplished in the tillage of this type. For this purpose the growing of leguminous crops is to be recommended. Clover does fairly well upon the better-drained areas of the Marion silt loam, and cowpeas can be grown upon a considerable proportion of the type. For the profitable growing of either of these crops, either as forage crops or for the purposes of green manuring, the land should be limed. Applications of finely ground limestone rock at the rate of 2 to 4 tons per acre, or where lime rock is not available, the use of the burned stone lime at the rate of about 1 ton per acre, are recommended for this purpose. If clover can be grown upon any particular farm it may be seeded with the winter wheat, cut for one year as a hay crop and the early growth of the second year turned under as a green manure. Cowpeas should be grown as a forage crop and may also be grown specifically as a green

manuring crop. It would be the better practice to grow the crop for forage purposes, to feed to dairy or beef animals, returning the resulting manure, and to plow under only the roots and stubble of the peas.

At present practically all of the vegetative growth of the usual crops on the Marion silt loam is sold from the farm. Even the wheat straw is sold to the strawboard mills, and practically no humus is reincorporated in the soil.

As a result of experimental tests it has been found that the crop-producing capacity of this soil is satisfactorily increased, especially for the small grains, by the application of phosphoric acid. The finely ground Tennessee rock is used and also acid phosphate. Applications range from 350 pounds to 500 pounds per acre. Other commercial fertilizers are little used except for special crops.

LIMITATIONS UPON SPECIAL CROPS.

Apples constitute the chief special crop grown upon the Marion silt loam. During the past 30 years thousands of acres of this soil have been planted to apple orchards in south-central Illinois. The Ben Davis largely predominates in all of the plantings, although Jonathan, Grimes Golden, Rome Beauty, and Winesap have also been grown. The tree growth upon the Marion silt loam is generally satisfactory, but there is a wide variation in the production of fruit. The better-managed orchards, where cultivation, spraying, and proper pruning are practiced, are profitable, but there are hundreds of acres of land already set to apples which are so poorly managed as to give little or no profit in ordinary years. The better drainage of the land devoted to orcharding, the breaking up of the "hardpan" layer, the frequent tillage of the orchard, spraying, and the growth of leguminous cover crops in the orchard are all essential to the success of commercial orcharding upon the Marion silt loam.

Irish potatoes are grown to some extent upon this soil, the crop averaging from 100 to 125 bushels to the acre. The method of mulching the potato crop with wheat straw instead of the intertillage of the crop is frequently practiced. This method gives a fair yield of clean, smooth potatoes.

The Marion silt loam can scarcely be recommended as a special soil for any other crops.

EXTENT OF OCCUPATION.

Practically all of the more level areas of the type are occupied for crop production. In east-central Missouri some of the steeper slopes have become so eroded that they have been abandoned for the growing of tilled crops, but even these are frequently grassed over.

Probably 90 per cent of the entire area of the type is now occupied for some form of crop production.

CROP ADAPTATIONS.

The Marion silt loam is better suited to the production of winter wheat than to any other crop. In some of the areas where it has been encountered fully 75 per cent of the area of the type is annually seeded to this crop and no rotation is practiced. In all of the areas of its occurrence winter wheat is the dominant grain crop. The yields secured vary considerably with the season and with the care taken in the preparation of the land. The wheat yields upon the most level tracts are frequently reduced by the presence of standing water during part of the winter months and early droughts or extremely hot weather while the grain is in the dough stage. The general average for the type is probably about 12 bushels per acre. This may fall as low as 8 bushels with unfavorable conditions or rise to 15 or 18 bushels when weather conditions have been unusually favorable. It is the common practice to seed the land to wheat for several years in succession and occasionally to seed in either timothy or mixed timothy and clover. Some fields of clover alone are grown. This constitutes the nearest approach to a crop rotation that is made over the greater part of the type.

Corn is grown only to a limited extent because of the presence of "hardpan" under the soil and the consequent tendency to drought during the latter part of the summer. Where the "hardpan" is not present or is found only at depths of 12 to 18 inches corn is grown with fair success yielding from 15 to 35 bushels per acre.

Oats constitute a fairly successful small-grain crop and yields of 25 to 35 bushels are secured. The acreage of this crop is limited when compared with that annually given to winter wheat. The latter crop is much better suited to the prevalent soil conditions than the summer grain.

Hay is grown upon a considerable area of the Marion silt loam. Timothy and redtop are seeded and the clover is seeded either alone or with the timothy. The yields of hay range from three-fourths of a ton to 1½ tons, probably averaging about 1 ton per acre.

Sorghum, broom corn, and cowpeas are grown to a limited extent. Upon all of the better-drained areas of the type cowpeas should be more extensively grown.

The use of the Marion silt loam as an orcharding soil has already been described.

FARM EQUIPMENT.

The Marion silt loam is fairly well equipped with farm buildings. Since farm animals are not numerous, the principal buildings consist

of the dwelling, barn for work stock, and sheds for tools and small farm animals. The machinery used is generally fairly adequate for the extensive production of small-grain crops. Teams of average weight are employed.

SUMMARY.

The Marion silt loam is an extensively developed prairie soil in south-central Illinois and east-central Missouri, which is better suited to small-grain farming than to any other type of agriculture.

The surface of the type is a nearly level prairie, interrupted only by stream channels and low elevations occupied by other types of soil. Drainage is imperfect and should be improved.

Winter wheat constitutes the most important crop upon this soil, with oats and hay also occupying a considerable acreage. Corn does not do well on the Marion silt loam.

Extensive areas of apple orchard have been planted and are profitable where proper care is given the trees.

For its improvement the Marion silt loam requires drainage, the incorporation of organic matter in the surface soil, and liming.

Approved.

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *January 15, 1912.*

APPENDIX.

The following table shows the extent of the Marion silt loam in the areas surveyed to this time. In the first column is stated the particular soil survey in which the soil was encountered; in the second column, its extent in acres; and in the third column, the volume of the Field Operations of the Bureau of Soils in which the report upon the area may be found. Those desiring a detailed description of the soil and of the general conditions which surround it in any particular area may consult these volumes in almost any public library.

Areas of the Marion silt loam encountered in the soil survey.

| Surveys. | Area of soil. | Date. ¹ |
|-----------------------|------------------|--------------------|
| Illinois: | <i>Acres.</i> | |
| Clay County..... | 260,544 | 1902 |
| Clinton County..... | 172,480 | 1902 |
| St. Clair County..... | 86,464 | 1902 |
| Missouri: | | |
| O'Fallon area..... | 174,552 | 1904 |

¹ Year of publication, Field Operations.







